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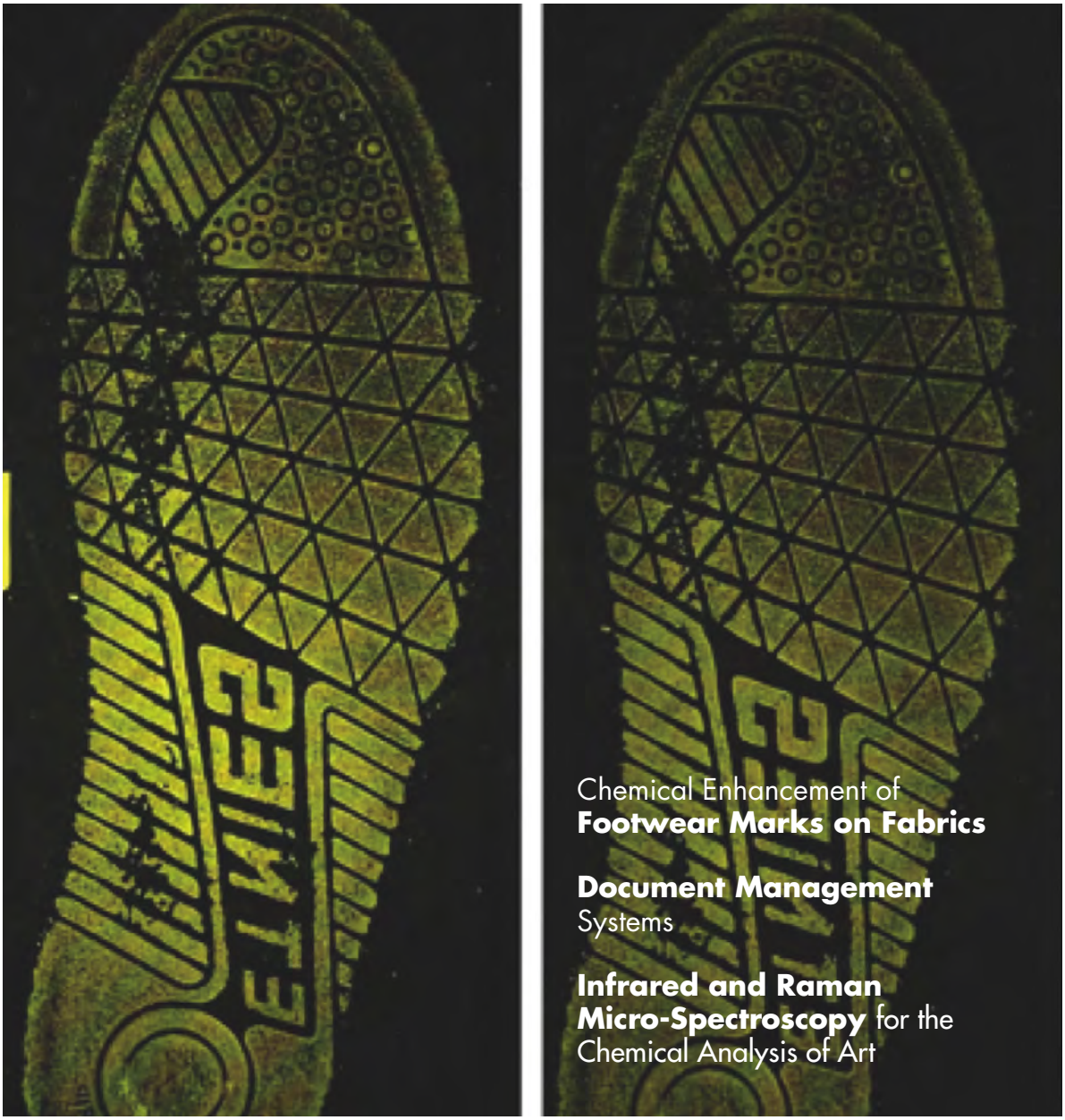

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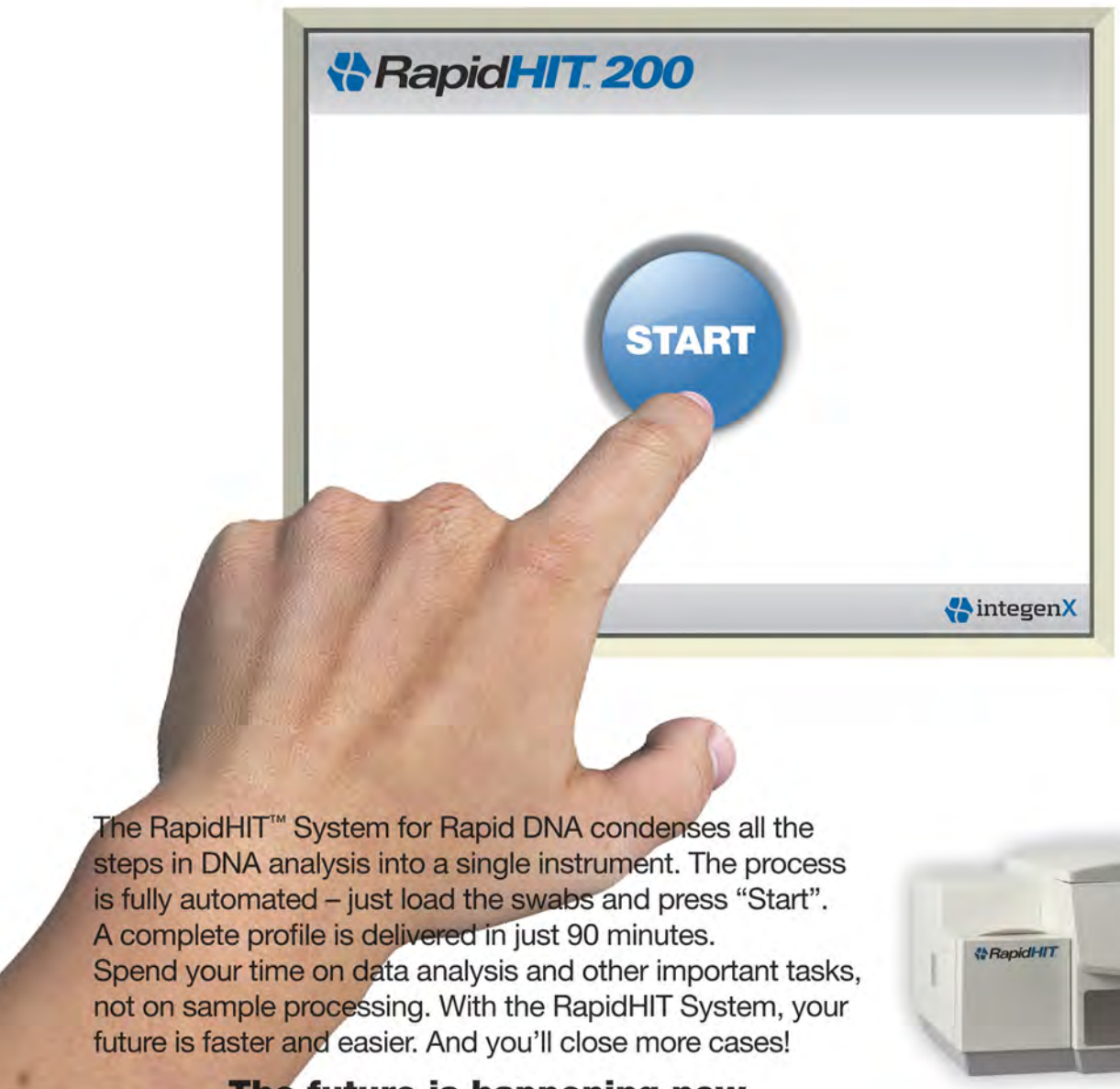

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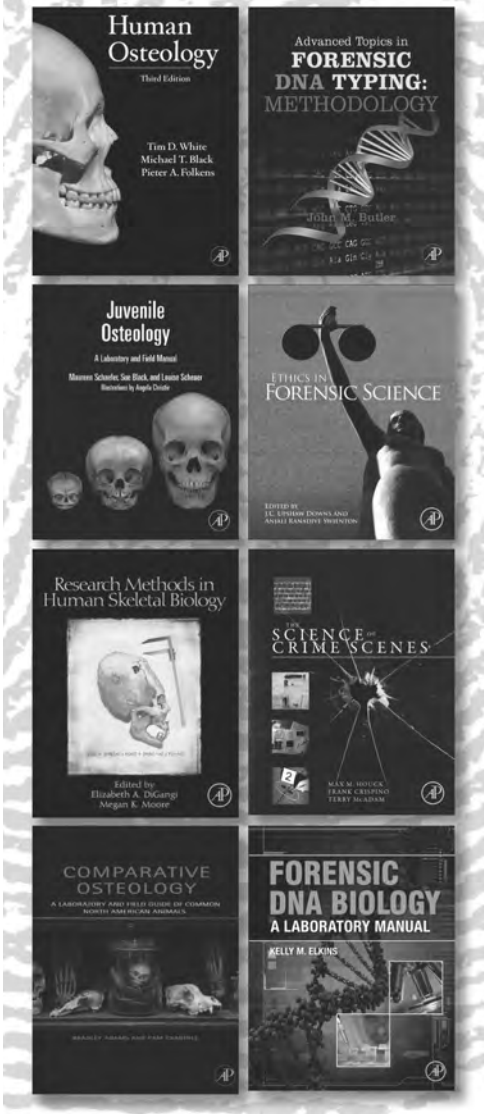

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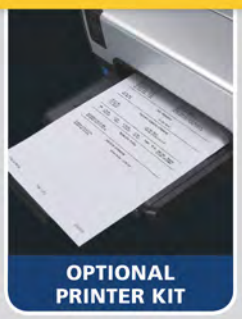
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point of
view

Peter Massey

FEPAC

The Forensic Science Education Programs Accreditation Commission (FEPAC), a commission under the auspices of the American Academy of Forensic Science, was created in part as an answer to an NIJ publication. The three page paper entitled "Addressing Shortfalls in Forensic Science Education" was initiated after the explosion in development of forensic science programs in colleges and universities across the country.

Many students had been watching the many shows on television highlighting forensic science careers and decided that was such an exciting and rewarding career that the educational market was created to accommodate all of the potential applicants and the tuition dollars that flowed with them. Unfortunately no one, at that time, was watching the curriculum that was being offered to these students. The Council of Forensic Science Education reported that "Students completing these programs expect to find employment in crime labs but are surprised to learn that lab management is not impressed by the curriculum." Sadly many programs' closest connection to what the lab directors are looking for are biology or chemistry programs where the director or coordinator had watched a TV series, attended a criminal trial, were ticketed on their way to work, or were of limited scientific curriculum as being off shoots of a criminal justice program.

FEPAC in part has changed this by establishing a framework of standards to improve forensic science programs. These standards were created with input from lab directors (ASCLD) and then members of the American Association of Forensic Science and its FEPAC commission and the Technical Working Group on Education (TWGED). The incorporation of these experts and hiring authorities set forth the foundation from which FEPAC accreditation is awarded.

FEPAC awarded its first program with accreditation in 2004 and currently has eighteen bachelor degree programs and twenty graduate programs accredited. The process is not easy and is dynamic. Some programs have lost accreditation for various reasons during the past nine years, an important fact indicating the difficulty in attaining accreditation and the fact that it is not a rubber stamp on an application. Sadly, in comparison to all of the college and univeristy programs offering some type of forensic science curriculum, the number that are or have been accredited is very low.

To be accredited a program needs to have support from its institution. It must have adequate classrooms and lab facilities. It is preferred that the faculty has experience working in a forensic lab and all must be adequately and appropriately qualified. The program must not rely on part time or adjunct educators, instead focusing on full time terminal degreed faculty. The faculty must also be able to balance teaching with research.

One of the other requirements of FEPAC accreditation is the establishment of a positive relationship with a forensic laboratory. The benefits of this cannot be overstated. Certainly many programs require that

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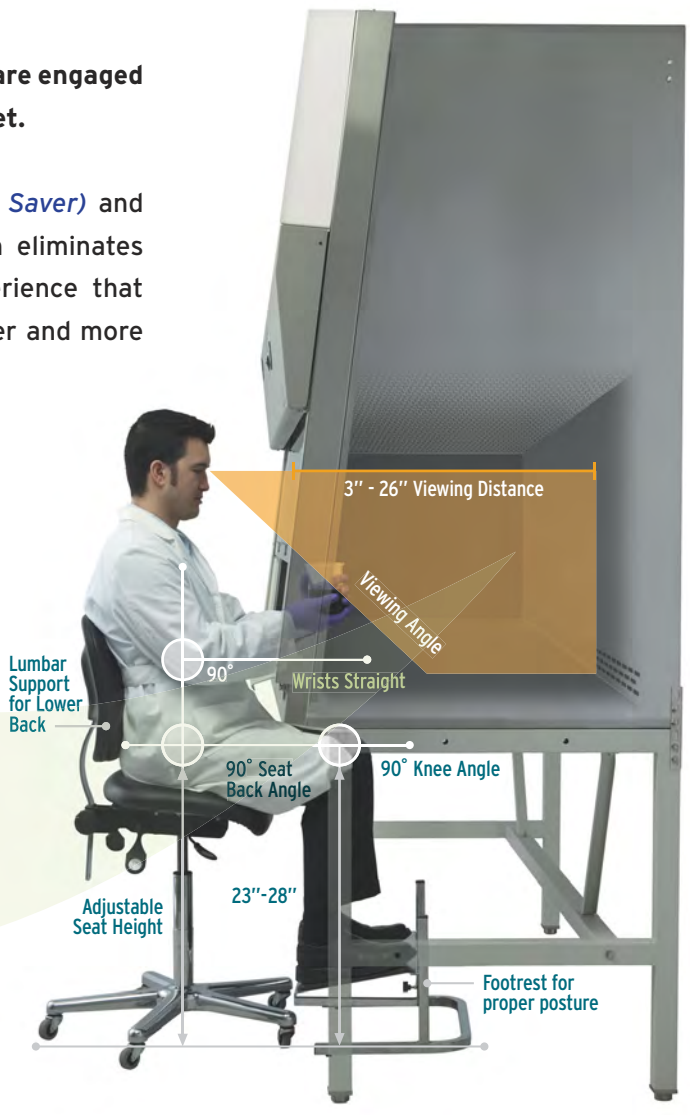

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students perform some type of internship. There is great value to both student and lab. One area where FEPAC accelerates this relationship is co-opted research. Many laboratories are understaffed and burdened with backlogs not allowing them to commit to one of their missions, developing research to further the profession. The strong relationship between an accredited program and its related laboratory allows for this collaboration, one which is looked upon favorably by funding authorities. A huge benefit for the lab is the possibility of shortened training periods allowing the employee to take on cases sooner, chipping away at backlogs, because of the strength of the science being taught as well as the hands on experiences.

FEPAC accredited colleges and universities also offer a benefit to prospective students and their families. Each accredited program must "toot their own horn" by publicly announcing such things as retention rates, number or percentage of students moving on to graduate programs, the number of students who attend professional meetings—thereby increasing their knowledge and visibility—and probably most important the number of graduates and where they are currently employed. Certainly this openness and information should be of a high priority to those looking into higher education, not just how beautiful a campus is, or how many freshmen share a room, or on a somewhat more difficult theme, the cost. The achievements attained by the students do not go unnoticed by prospective employers.

Does graduation from a FEPAC accredited program offer a better opportunity for employment? Currently there is not enough data to fully assess this. One study indicated that 70% of lab directors were aware of FEPAC and what accreditation means, 25% of hiring personnel were aware of FEPAC, and 40% of heads of laboratories acknowledged an advantage for those graduating from an accredited program. Unfortunately this sentiment was not felt by the human resource folks.

On the surface forensic science programs may appear to be similar, but what FEPAC does is dive deeply into those programs, separating out those that definitely will prepare and provide graduates with the theoretical knowledge and hands on experiences desired by employers from those that may or will not. Lab directors should look with more assurance at those potential hires from FEPAC accredited programs and potential students and their families should consider fully accredited programs with the guarantee that that program has been fully vetted.

Peter Massey *started his career at the Hamden, CT Department of Police Services rising to the rank of Detective. Over his nine years at the University of New Haven he has taught courses in Criminal Justice and is currently a full time faculty member in the Forensic Science Department, as well as an academic advisor for their students.*

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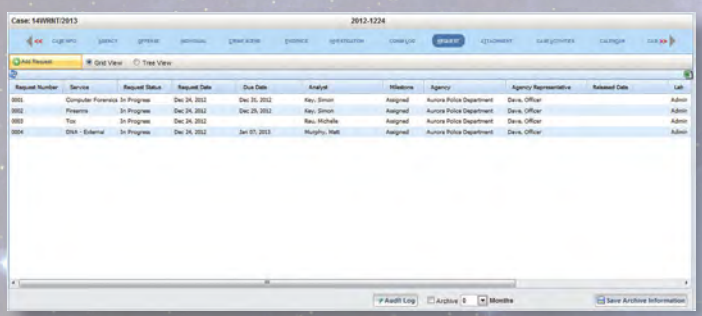

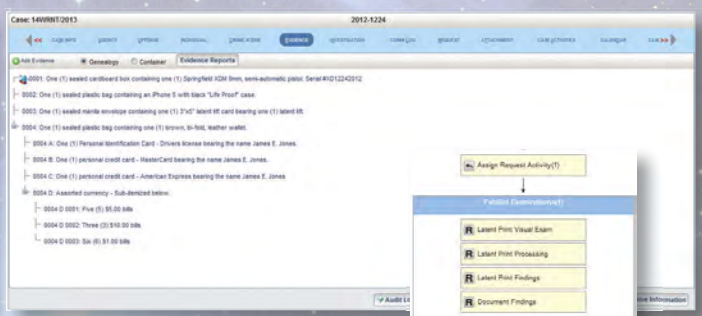

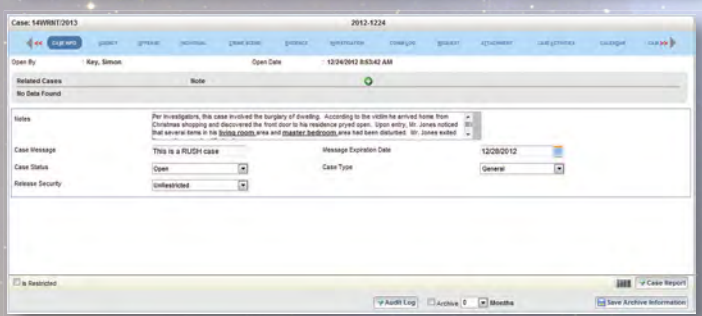

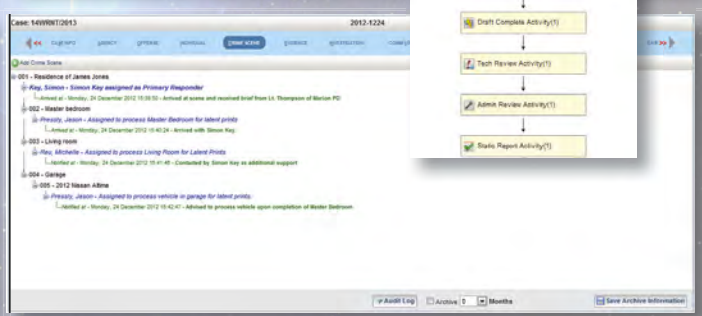

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Chris Asplen

Innocence Projects Abroad

As I write this column today, on the front page of the *New York Times* is a story about Joseph A. Buffy, who 11 years ago at the age of 19 was accused and convicted of raping an 83-year-old woman. He has subsequently been exonerated through DNA testing and another inmate, in another prison, in another state, has been connected to the crime through a DNA profile. The article uses the Buffy case to highlight the issue of allowing defense attorneys access to the CODIS database system. And I must confess, it takes every bit of self-restraint right now to resist writing this column about the irony of a defense community, the vast majority of whom will object at every turn to any expansion of the DNA database, that argues their right to access that same database because of its exonerative power. But resist I shall—at least for now. Instead, what the Buffy case and this article exemplify is the intertwined nature of DNA exonerations and greater DNA utilization in general. It also highlights the value of two global examples where DNA exonerative efforts are growing.

There have been a number of broad policy and legislative initiatives in the United States that have driven the use of DNA technology and the CODIS database to help solve crime, protect the innocent, and prevent future victimization. The President's Initiative on DNA, The Debbie Smith Act, and the recently passed Katie Sepich Enhanced DNA Federal Law were all substantial steps toward a full integration of DNA into our criminal justice system. But the first big effort by the U.S. government to maximize the potential of DNA technology came with the Department of Justice's National Commission on the Future of DNA Evidence. However, what most people don't realize is that, while that was a time of extensive investment in and expansion of CODIS and FBI laboratory resources, it wasn't the investigative power of DNA that prompted the Attorney General to create a "National" commission. Rather, it was the exonerative power of DNA, illustrated in the National Institute of Justice Study: "Convicted by Juries Exonerated by Science: Case Studies in the Use of DNA Evidence to Establish Innocence After Trial," that prompted Attorney General Reno to create the Commission. It wasn't 26 violent rapes that were solved, nor was it 26 CODIS hits. It was 26 convictions which were proven to be undeniably wrong through DNA testing that drove the first broad effort to enhance law enforcement training, increase laboratory funding, and expand the scope of databasing.

Now, in two other countries, efforts focusing on the protection and exoneration of the innocent through DNA technology may help bring about safer and more just societies. Innocence projects in The Philippines and South Africa offer an avenue for the legal systems in those countries to begin to appreciate the impact of implementing DNA technology more fully.

This December, Dr. Maria Corazon De Ungria of the DNA Analysis Laboratory, Natural Sciences Research Institute, University of the Philippines (UP), Attorney Jose Jose of the Office of Legal Aid, UP College of Law, and numerous partners launched the Innocence Project Philippines Network (IPPN) at the National Bilibid Prison. Law students and faculty from UP, Ateneo de Davao, and De La Salle University, volunteers and partners from the Free Legal Assistance Group, Coalition Against the Death Penalty, Philippine Jesuit Prison Service, UP DNA Analysis Laboratory, and three lawyers from Cebu, including one from Southwestern University, went to the National Bilibid Prison to attend the launch and to interview prisoners who claim to have been wrongfully convicted. The participants from Davao and Cebu are planning to launch the Innocence Project Philippines in the penal colonies within their own regions. Life Technologies, also assisting with the launch, has donated molecular reagents and consumables when a case requiring post-conviction DNA tests is found.

Through a series of launch events, outreach projects, and training programs, the IPPN has systematically introduced a dynamic project in a country with a judicial system in significant need of assistance. Having toured the National Bilibid Prison several years ago with Dr. De Ungria, I can tell you that, as horrible as wrongful conviction is anywhere it can be found, it's worse in a Philippine prison. I've seen the prison first hand and to say that the conditions and provisions (or lack thereof) in a Philippine prison constitute human rights viola-

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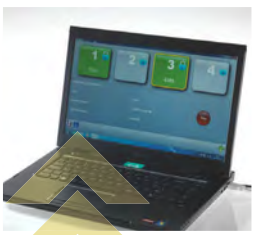

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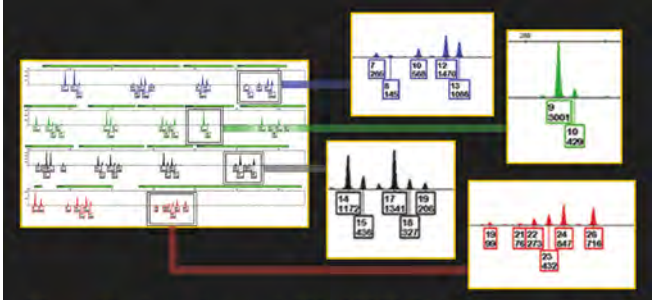

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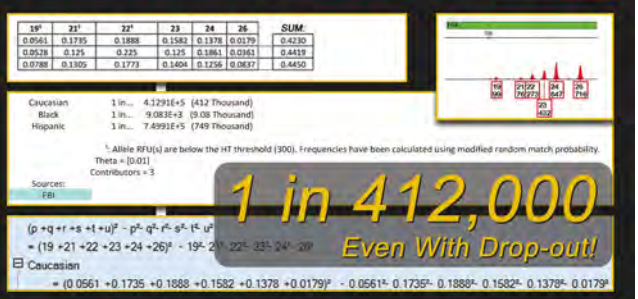

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tions themselves is an understatement.

It is no surprise to me that Dr. De Ungria has undertaken this project and created a dynamic program with very limited resources. The exonerative power of DNA is not new to her. At her request, I traveled to the Philippines ten years ago because, even then, they were using DNA in an exonerative context through a grant from the European Union. Since seeing their work back then, she has been one of my favorite speakers to recommend around the world to those looking to implement DNA with limited resources. Dr. De Ungria's work for the past ten years, culminating in the launch of the official Innocence Project Philippines Network at the National Bilibid Prison, is proof that vision and leadership can drive change in the face of significant systemic and financial limitations.

Now, if you read this column, even only occasionally, you know that I love South Africa. But it drives me crazy. The disconnect in South Africa between the sophisticated potential of forensic DNA and the actual benefits of its application result in the significant loss of life on a daily basis. But there is now yet another effort to leverage DNA's potential fight the battle of injustice in South Africa.

Last October, as part of their advisory committee, I attended an organizational meeting of the Innocence Project SA in Cape Town, South Africa. Also in attendance were Dr. De Ungria and Attorney Jose (of course); Ed Huffine, Vice President International Development at Bode Technologies; Vanessa Lynch, Executive Director of the DNA Project, SA; Oliver Preisig of Inqababiotec; Dr. Eugenia D'Amato of the University of the Western Cape; Prof Gerhard Kemp from Stellenbosch University; and the Project's primary driver, Prof Sean Davison, head of the forensic DNA Laboratory at the University of the Western Cape.

While in earlier stages of development than the project in the Philippines, the Innocence Project SA is on its way to develop the necessary resources, establish the relationships, and maximize the considerable legal and scientific expertise found in that country that will bring hope to the wrongfully convicted and a vision for the broader impact that forensic DNA can have on the judicial system.

Focusing on casework, research, communication, and reform, the IPSA maintains a vision that extends beyond the utilization of DNA for exoneration purposes. It recognizes that it can also act as a forum to identify where investigative methods, both forensic science based and not, have been effective or have lead to wrongful convictions. As such, it looks forward to having a broad impact on the nature and quality of justice in South Africa.

While I started out writing about the connection between exonerations and database expansion, I am not suggesting that anyone involved in these projects look

for that result specifically. As I noted a bit sarcastically above, it is possible to be wholeheartedly in support of identifying the wrongfully convicted through DNA while at the same time considering database expansion to be somewhat in violation of civil or humanitarian rights. But whether they intend it to or not, the inescapable conclusion to be made from these programs will be, as it was in the United States, that if appropriate resources were dedicated to empowering law enforcement to leverage the power of DNA in the first place, there would be significantly less need for their existence.

But currently, there is significant, and I will go so far as to say desperate, need for their existence and important work. As such, I have provided their Web site addresses below. If you visit the sites, you will notice among other things, a donation page. And since you are reading this column in the first place, you are connected to this issue enough to know that in both of those countries there are people sitting, figuratively and literally, in very dark places, suffering the daemons that sit on the shoulders of the wrongfully imprisoned. They would very much appreciate it if you would consider helping Dr. De Ungria and Dr. Davison to help them.

The Innocence Project SA: http://innocenceprojectsa.com/

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Chris Asplen *is President of Asplen and Associates, LLC. He consults with local, state, federal, and international governments on the use of forensic DNA technology. chrisasplen@gmail.com*

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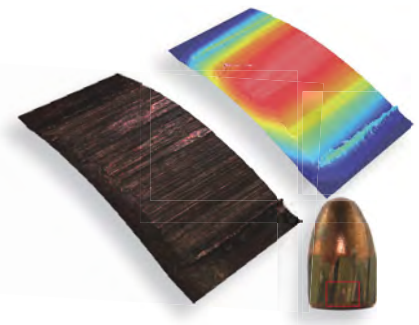

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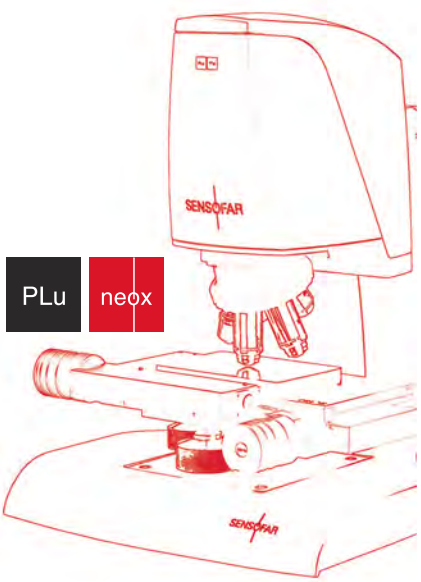

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Utilization of Infrared and Raman Micro-Spectroscopy for the Chemical Analysis of Art

Thomas J. Tague Jr, Ph.D.

The analysis of art objects is conducted for a variety of purposes with authentication being the most visible purpose. Before its recent restoration, the *Salvator Mundi* was thought to be one of a number of copies of the long-lost Leonardo da Vinci painting. It was not until layers of discolored varnish and overpaint were removed that the extraordinary paint handling and surface effects were revealed.[1] A complete authentication process involves the analysis of provenance, technique, and historical background coupled with the application of modern scientific methods. Forgeries are common in today's market and are increasingly challenging to detect by the use of traditional methods alone. An equally important purpose is to gain an understanding of the chemical content for conservation purposes. For example, if a lacquer has been applied to a painting that has a different coefficient of thermal expansion than the paint initially applied by the artist, cracking and other degradation of the painting can occur. The analysis can also be important for the continued preservation of works of art. Understanding what wavelengths of light can be damaging to an object can provide significant guidance to the best environment for storing and displaying the object. For example, through the utilization of atomic force microscopy and Raman spectroscopy, daguerreotype photographic plates have been found to degrade significantly under ultraviolet illumination.[2] As it is highly desired to remove as little material as possible from the work in question, microanalysis systems are best employed.

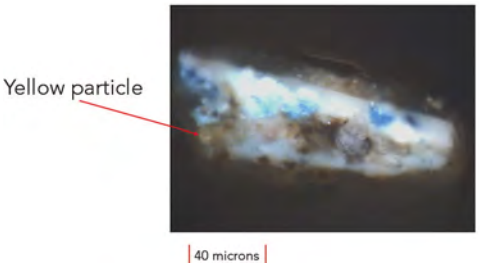


Figure 1: Fluorescence visible in an image of a small section removed from a painting.

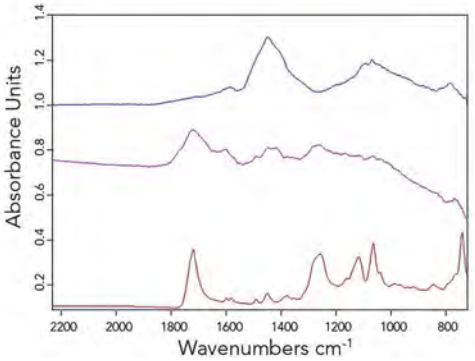


Figure 2: Representative infrared spectra collected from the paint sample shown in Figure 1. The top spectrum is from a tan layer, the middle spectrum from the yellow particle, and the bottom layer from the mounting media (appears black in the visible image).

The important task of analyzing works of art is usually one that involves the employment of an array of techniques including optical microscopy, x-ray diffraction (XRD), x-ray fluorescence (XRF), scanning electron microscopy (SEM), as well as infrared (IR) and Raman spectroscopy. Essentially, the task of characterization can be divided into two areas of interest; the physical properties of the sample and the chemical properties of the sample. Optical microscopy, XRD, XRF, and SEM yield information pertaining to the physical properties of the sample and IR and Raman provide the complementary chemical information. Because IR and Raman spectroscopy access fundamental modes of vibration, they are highly specific for identification purposes. The analysis is furthered by the existence of extensive chemical reference databases. Ideally, the spectrum is collected and searched over the relevant databases for identification purposes. If a match is not found, then a careful examination between absorption band positions and intensities must be conducted to identify the compound in question.

Figure 1 shows the fluorescence image from a sample removed from a painting. The size of the paint sample should be as small as possible, while being substantial enough for analysis, typically 100x100microns. Many pigments undergo fluorescence upon UV illumination, thereby resolving different layers. The corresponding infrared spectra were collected using an infrared microscope and are shown in Figure 2. The spectra were collected using an ATR objective that has a contact area of 100 microns. A field aperture located

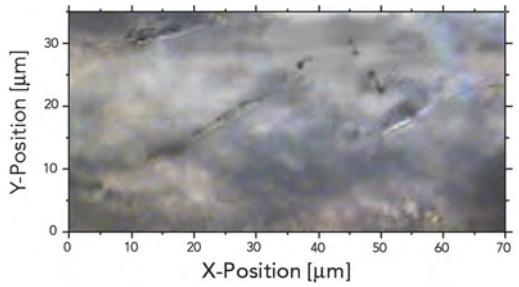
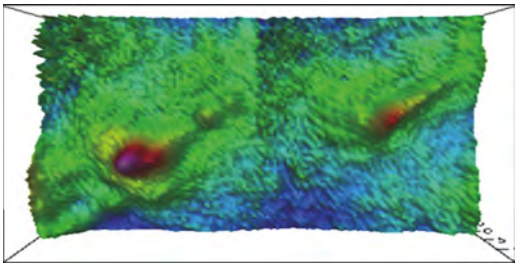
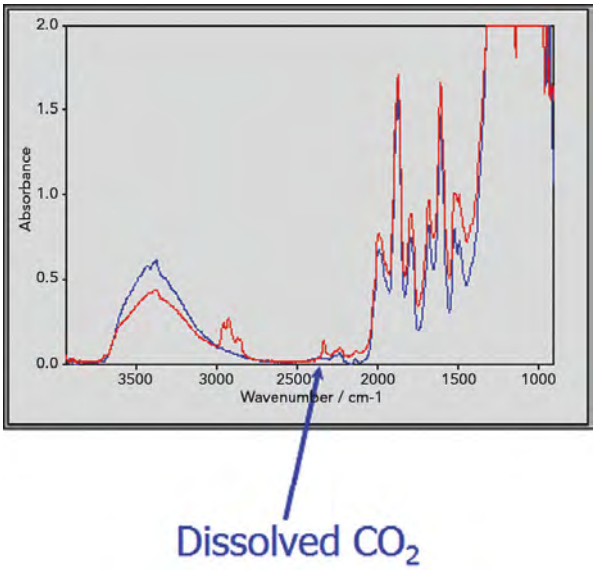


Figure 3: Quartz sample with gaseous inclusions.





in a conjugate image plane defines the area of analysis. Because a germanium crystal was used as the internal reflection element, the spatial resolution was improved to 4x smaller than the wavelength of light. For the spectra shown in Figure 2, the remote aperture was set to 24x24microns, yielding 6x6 microns at the sample. This was sufficient to resolve the suspicious looking yellow particle. Visually, the yellow particle looked polymeric, which would be out of place for a work of art thought to be more than 200 years old. The infrared spectrum clearly indicates that the particle was not polymeric by the lack of bands associated with polymers.

The down side to ATR analysis is that there is contact between the ATR crystal and the sample. It is also possible to analyze art by direct reflectance. In this case, the infrared light is bounced off the surface of the object. If the object reflectance is greater than ~4–6%, then the dispersion off the surface is measured. The absorbance spectrum can then be readily obtained through data processing. If the sample is less reflective, then a diffuse reflectance result is obtained. For reflectance measurements it is best to use high numerical aperture objective for optimal collection of the resultant light. Reflectance data acquisitions have the advantage of being non-contact, but the signal is weaker than ATR and requires post-run data manipulation. Another important consideration is whether to collect information from a single point or an area. Modern infrared microscopes allow rapid area imaging in transmission, reflectance, and ATR modes.

Figure 3 shows the visual image of a quartz sample on the top and the infrared image is shown below. The quartz sample has gaseous inclusions which appear as clear thin lines and upon identification can provide insight into the conditions present during formation. The quartz object was polished to a thickness of 25 microns. The infrared image was collected in transmission in two minutes. Each point on the image is composed of an infrared spectrum that spans the middle infrared. The blue spectrum is a spectrum extracted from the bulk material and the red spectrum is from air pockets trapped in the quartz. It is readily determined that the inclusions contain carbon dioxide and hydrocarbon molecules. Area imaging allows not only the detection and identification of components, but an easily understood assessment of the distribution as well. The use of a full-field infrared imaging detector allows for diffraction limited spatial resolution.

Raman spectroscopy has been used for many years in the art and forensic communities for the identification of materials that have a weak infrared signal or have characteristic bands below the cutoff of typical infrared detectors. Photoconductive mercury-cadmium-telluride (MCT) detectors that are typically employed have a long wavelength cutoff of about 600 cm^{-1}. Modern Raman microscopes routinely allow the detection and identification of inorganic pigments that frequently have spectral signatures down to ~50 cm^{-1}. Because Raman spectroscopy, like infrared spectroscopy, accesses fundamental modes of vibration it is highly specific for chemical identification. This can be vital in the analysis of pigments and dyes which frequently have important vibrations below this. It is worth noting that Raman

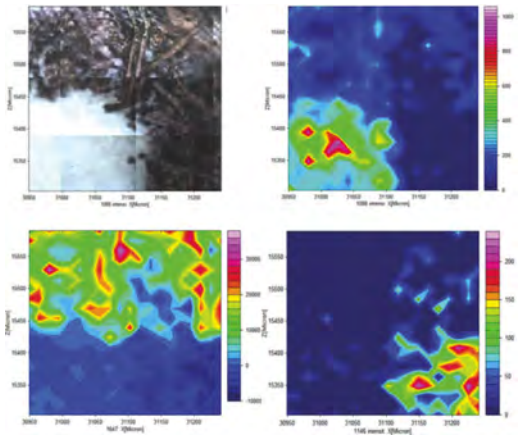


Figure 4: Visible image of pen ink crossing (top left), Raman chemical images of paper (1088 cm^{-1} integration) (upper right), z-grip pen (1647 cm^{-1} integration) (lower left), and image of the ball point pen (1146 cm^{-1} integration) (lower right).

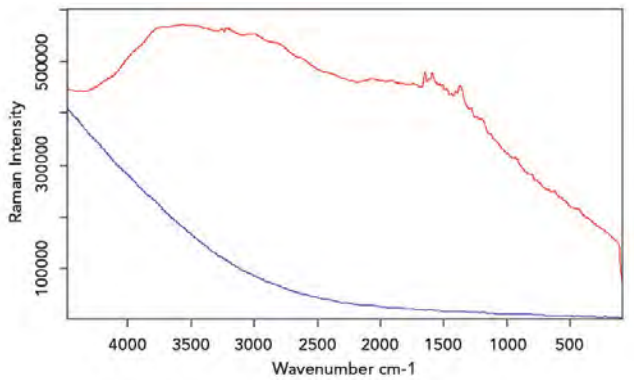


Figure 5: Raw Raman spectra of z-grip pen (top, offset) and ball point pen (bottom) collected at 532nm.

analysis is non-destructive and allows *in situ* analysis even when applied to investigations in aqueous solutions.

Document analysis can be broken down into a few categories of investigation: authentication, detection of alteration, and determination of origin. The detection and characterization of ink applied after the creation of a document is important in determining whether a document has been altered. Confocal Raman microscopy can be applied such that a depth profile can be performed on the ink in question to determine which was applied first. The depth resolution for confocal Raman microscopy is defined by the Rayleigh criterion and is about 1 micron.[3] If ink is applied first and allowed to dry, subsequent application of ink would sit on top of the earlier deposited ink. If an ink applied later is composed of a different pigment, Raman would readily differentiate between the inks. Figure 4 shows a micrograph of an ink crossing from a document containing two different inks and its corresponding Raman images. Figure 5 shows the raw Raman spectra collected from the ball point pen (top) and the z-grip pen (bottom). The Raman spectra were collected using a Raman microscope at 532nm with a 1s integration in the confocal mode of operation at a resolution of ~3 cm^{-1}. The Raman microscope was mounted on a z-stage to allow access to large samples as shown in Figure 6. The Raman spectra shown have undergone removal of the fluorescence by utilization of a concave baseline correction method.[4] Prior to fluorescence removal, the overlaying Raman spectra are barely observable. The 1648 cm^{-1} band was integrated for the z-grip image and the 1146 cm^{-1} band for the ball point pen image. The ball point pen was readily identified as methyl violet and the z-grip ink as methyl violet with an additive. It is clearly evident that the z-grip pen was applied over the ball point pen.

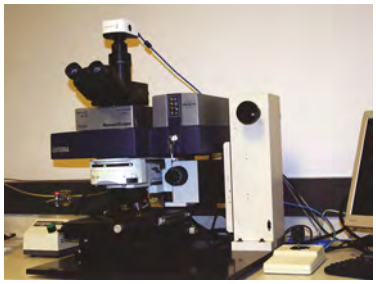


Figure 6: Raman microscope mounted on a z-stage.

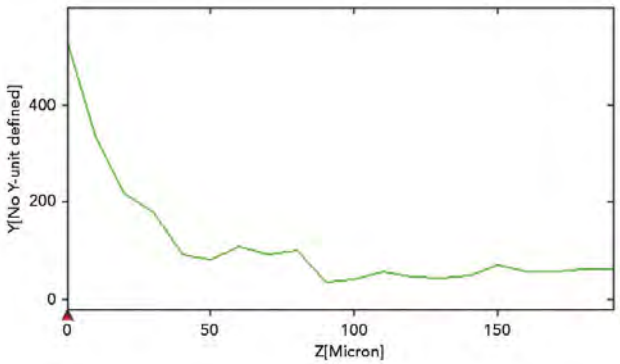


Figure 7: Depth profile of z-grip pen as a function of depth.

We can extend the investigation further by bringing the document through the field of focus to depth resolve each of the inks at the junction point, as shown for the z-grip pen in Figure 7. The depth profile was conducted by stepping in 1 micron steps from the top surface focus position into the sample for a total of 200 microns. As expected the spectrum at the interface was composed of a combination of the spectra representative of both inks. This example demonstrates the facility of confocal Raman microscopy for document analysis, so long as the fluorescence can be effectively removed.

Another document was examined with surface enhance Raman spectroscopy (SERS) to determine if the fluorescence could be effectively quenched while achieving a significant signal enhancement. This document contained phthtalo blue and methyl violet inks. The 488nm spectrum showed some peaks of both over a strongly fluorescent background. Both the paper and methyl violet ink contributed to the fluorescence signal. Using 785nm

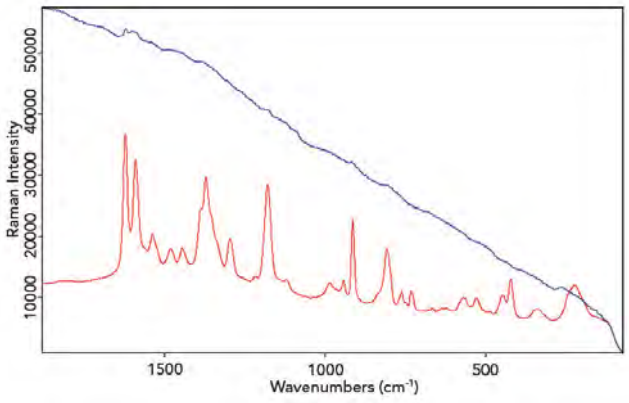


Figure 8: Raman spectrum of the ball point ink on paper with 488nm excitation (top) and the corresponding SERS spectrum after silver colloid deposition (bottom).

excitation did not improve the signal much because, as the fluorescence of methyl violet decreases, phthalo blue becomes slightly fluorescent. In this case, a droplet of silver colloid suspension, prepared using a previously described method where microwave assisted reduction is employed, was deposited onto the document using a piezo device prior to analysis.[5,6] The silver colloid droplet size was about 20 microns in diameter. Figure 8 shows the Raman spectrum without correction (top) and the SERS result (bottom). It is clear that the fluorescence was effectively quenched and a very high quality SERS Raman obtained. This striking example demonstrates the promise of using SERS microscopy for the detection of very small amounts of dyes and pigments even on fluorescing substrates such as paper or even skin.

In conclusion, while infrared and Raman microscopy have been employed for many years in the field, new capabilities, such as the employment of FPA detectors and ATR immersion optics in the infrared and confocal depth profiling, fluorescence reduction, and SERS for Raman, have dramatically improved the ability of infrared and Raman microscopes to be used in the increasingly challenging area of art analysis. Lastly, infrared and Raman microscopes are readily available with very user friendly software interfaces and self-validation capabilities that ensure good instrument performance.

References can be found online at www.forensicmag.com/article/utilization-infrared-and-raman-micro-spectroscopy-chemical-analysis-art.

Thomas Tague *is the Applications Manager for Bruker Optics. He is also a member of the Advisory Boards of the Metropolitan Museum of Art in New York and EOS Photonics. Dr. Tague received his Ph.D. in 1992 from the University of Utah in Chemistry and his B.S. also in Chemistry from the University of Texas at San Antonio in 1988. He is a member of the American Chemical Society, Society for Applied Spectroscopy, and the Microscopy Society of America.*

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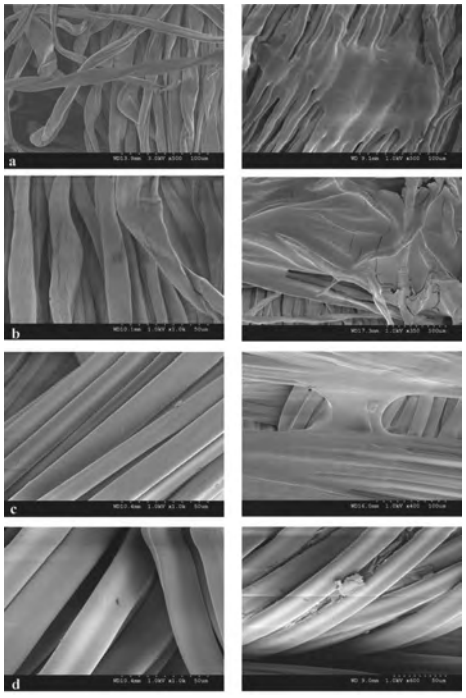

Figure 1: SEM analysis of fabrics before (left) and after (right) the deposition of blood on: a) white cotton, b) patterned cotton, c) white polyester, d) white nylon/lycra.

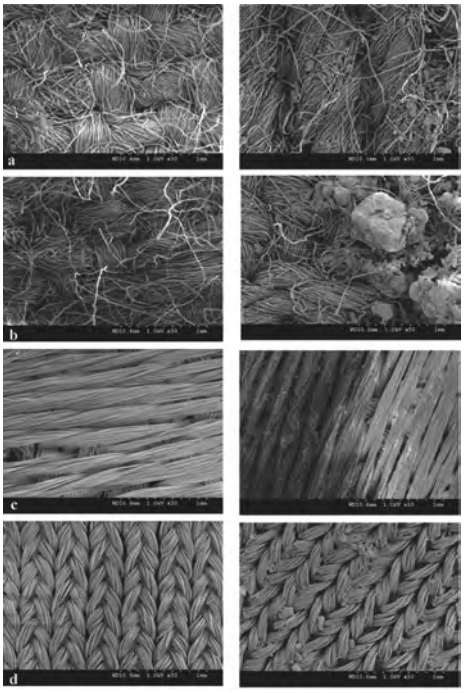

Figure 2: SEM analysis of fabrics before (left) and after (right) the deposition of soil on: a) white cotton, b) patterned cotton, c) black polyester, d) black nylon/lycra.

Comprehensive Analysis of the Chemical Enhancement of Footwear Marks on Fabrics

Niamh Nic Daeid

Footwear impressions are the most frequently encountered evidence at crime scenes after DNA and fingerprints. They can provide information to demonstrate or exclude the presence of an item of footwear at a crime scene. Footwear impression evidence became a priority for the UK Association of Chief Police Officers (ACPO) following changes in 2006 in the UK legislation to the Police and Criminal Evidence (PACE) Act 1984. This empowered police officers to take footwear impressions or to seize footwear from apprehended suspects for subsequent examination. This also generated an operational need to evaluate footwear enhancement techniques.

The UK Home Office Centre for Applied Science and Technology (CAST), in collaboration with the Centre for Forensic Science (CFS) at the University of Strathclyde, Glasgow, Scotland, worked together on a strategic research project to evaluate existing chemical enhancement techniques for their applicability to footwear enhancement for marks made in blood, urine, and soil on various fabric surfaces. The James Hutton Institute, Scotland, contributed their expertise and comprehensive experience in soil composition and analysis to that aspect of the project work. The research was led by Professor Niamh Nic Daeid and Dr. Katy Savage at CFS and Dr. Helen Bandey at CAST. In addition, the research team explored the effects of different soil characteristics on the efficacy of the chosen enhancement reagents with Professor Lorna Dawson of the James Hutton Institute. The laboratory work was carried out by Kevin Farrugia while completing his Ph.D. at the CFS under the supervision of Professor Niamh Nic Daeid.

The purpose of the research was to scientifically and robustly evaluate and establish the appropriate enhancement techniques and to understand the mechanisms for the development of footwear impressions made in operationally relevant contaminants on different colors and types of fabric. This included establishing the topographical and physical characteristics of the fabrics and influences that these may have on the subsequent enhancement of the footwear impression. Scanning Electron Microscopy (SEM) of the various fabric types and the interaction of the contaminants with these fabrics provided insight as to how materials such as blood and soil penetrated into the materials (Figures 1 and 2). The "porosity" of the fabrics was also assessed. In the case of wet contaminants (blood and urine), the surface morphology of the fabric had little effect on the enhancement abilities of the various reagents investigated, while the success of enhancement on footwear impressions in soil depended on both the soil type and on the fabric surface morphology.

Blood

The aim of this work was to provide a comprehensive comparison of the ability of a number of peroxidase reagents and protein stains to enhance

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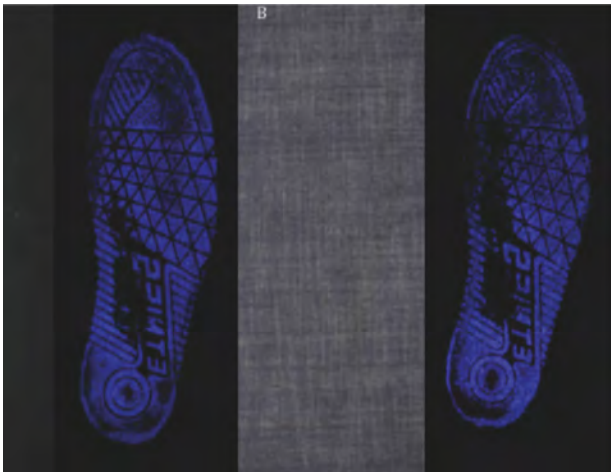

Figure 3: Enhancement of a footwear impression in blood on black cotton (a) and denim (b) with Luminol.

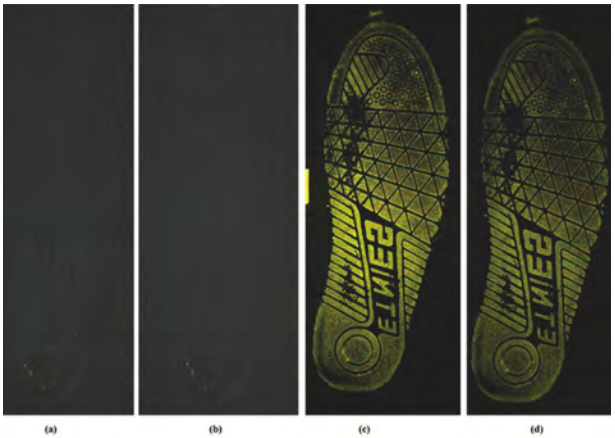

Figure 4: Enhancement of a footwear impression in blood on black nylon/lycra: a) impression in blood, b) enhancement with AY7 under white light, c) AY7 fluorescence using Blue Crime-Lite™, d) AY7 fluorescence using Quaser 40

footwear impressions made in blood on a range of fabric types and colors. Of the peroxidase stains, Luminol (Figure 3) was the best performing enhancement technique overall, enhancing impressions on all fabrics examined and was the only technique to provide a clear enhancement of the impressions on denim and leather. However, careful application is required as diffusion of the mark can occur. Leuco crystal violet (LCV) and Leuco malachite green (LMG) provide good enhancement on patterned cotton and light colored fabrics but are poor enhancers of impressions on darker fabrics. Acid Yellow 7 is the most suitable protein stain for footwear impressions made in blood and deposited onto dark fabrics (Figure 4). AY 7 provided some excellent enhancement and had the added advantage of fixing the mark *in situ* so that fine detail could be observed and no distortion of the mark was evident (Figure 5).

Alginate casting material can also be used to recover marks left in blood and can easily be prepared and applied at a crime scene if the article cannot be moved to the laboratory. Lifting with alginate followed by enhancement with Acid Black 1 provided good definition for all impressions on all fabrics including denim (Figure 6).

Urine

Urine from different individuals can exhibit different fluorescent properties but in general strong fluorescence is observed by using a violet/blue wexcitation source (350-469nm), viewing with a yellow filter (476nm). Four reagents, 1,2-indanedione (1,2-IND), ninhydrin, 4-dimethlyaminocinnamaldehyde (DMAC), and 1,8-diazafluoren-9-one (DFO) all provide some enhancement of the marks to varying degrees. In some cases enhancement was observed after a period of two months post deposition. DFO provided the best enhancement of footwear marks in urine but only on lighter colored fabrics with more porous fabrics (cotton and patterned cotton) providing the best results (Figures 7 and 8). The presence of dyestuffs or other chemical products were shown to inhibit the observed fluorescence in some cases.

Soil

Results indicated that the soils investigated were more likely to respond to reagents that target iron rather than calcium, aluminum, or phosphorus. A range of common soil types found in the UK were investigated. Furthermore, the concentration of iron and soil pH did not appear to have an effect on the performance of the enhancement techniques. Of the chemical enhancement reagents tested, 2,2'-dipyridil was a suitable replacement for the more common enhancement technique using potassium thiocyanate (Figure 9). The main advantages to this alternative are the use of less toxic and less flammable solvents and improved clarity and sharpness of the enhanced impression. However, a slight tendency for diffusion to occur on less porous fabrics (e.g. polyester and nylon/lycra blends) caused some minor distortion of these marks.

Figure 5: Fine detail within the AY 7 enhanced mark.

The research completed by the team has been presented widely and has led to a series of scientific journal publications detailing all of the enhancement methods evaluated in the work.

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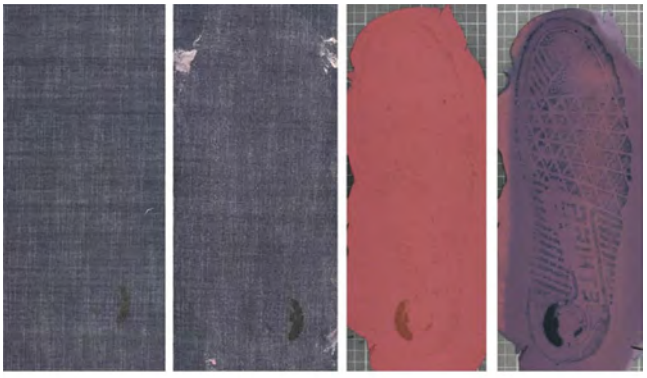

Figure 6: Enhancement of a footwear impression in blood on denim using alginate and Acid Black 1: a) impression in blood before enhancement, b) impression in blood after lifting alginate, c) alginate lift, d) alginate lift enhanced with AB1.

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Figure 7: Enhancement of a footwear impression in urine on patterned cotton: a) 2 month old urine impression, b) DFO enhancement under white light, c) DFO enhancement using a Quaser 40 green excitation source.

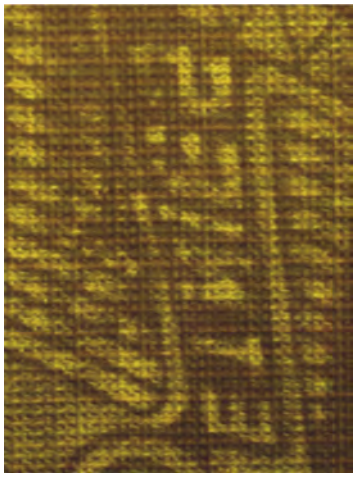

Figure 8: Fine detail within the DFO enhancement using a Quaser 40 green excitation source.

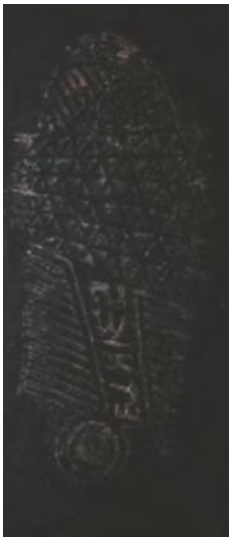

Figure 9: Enhancement of soil mark on black cotton using 2,2'-dipyridil.

Niamh Nic Daeid *is Professor of Forensic Chemistry at the Centre for Forensic Science, University of Strathclyde, Glasgow. She leads a large multidisciplinary research team in forensic science at CFS and has many years of experience in forensic chemistry. n.NicDaeid@strath.ac.uk*

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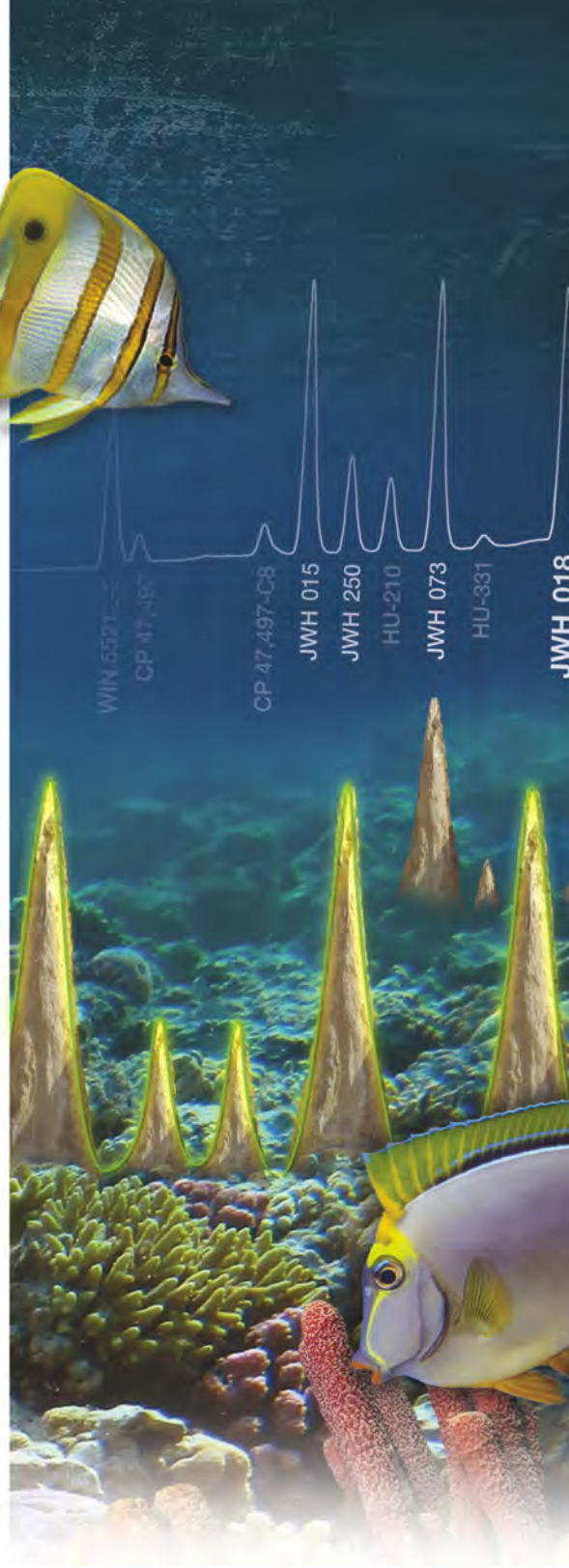

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Not Sexy Enough For Hollywood, Document Management Systems Are Still At the Core of Quality Management in Labs

Advice from the Alabama Department of Forensic Sciences on implementing a document management system.

Katie Gignac

You don't see Hollywood glamorize the quality management staff of forensic laboratories on *CSI* or *Bones*. Admittedly, ensuring processes and procedures are followed and maintaining your lab's accreditation is not the sexiest visual for a television audience, but in the world of forensics, quality and consistency are the name of the game.

Just ask Faron Brewer, quality manager for the Alabama Department of Forensic Sciences. He's been with the department for 22 years and knows a thing or two about quality assurance and its history in the field. When Brewer began his career, computers were a rarity. How computers would impact the quality field was only a glimmer.

"I've seen great advances in quality assurance and accreditation of forensic laboratories over the years," says the affable Brewer, who stressed just how much things had changed since his early days in the field. "Standard operating procedures were much easier for us to keep updated after computers were introduced."

In the late 1980s and early 1990s, the first few computers in the Alabama forensic labs served to connect a network of facilities across the state and help them coordinate and collaborate. But it wasn't until 2003, when the department implemented a lab information management system, that processes really began to hum. That year, the department was accredited by the American Society of Crime Laboratory Directors/Laboratory Accreditation Board (ASCLD/LAB).

"Prior to that point, almost everything we did was manual—printing documents, checking, marking them up, filing them in folders," recalls Brewer. "It took a lot of time."

Of course, the labs' reliance on technology has only increased since then, and in his position overseeing quality in a lab system that employs about 200 staff in eight facilities, Brewer sees buy-in at all levels when technology can improve process or procedure. That's why in 2010 he and his team began to investigate document management systems.

"My peers in the Association of Forensic Quality Assurance Managers gave me a glimpse of what other labs were doing," explains Brewer. "Some of the labs I spoke with were small, but all of them saw marked improvement in their processes with a document management system in place. I figured if it worked for them, it would work for us."

And it has.

Brewer and his colleagues asked their peers for recommendations on software providers and ultimately chose Qualtrax as their document management solution. It had the functionality they needed and was easy to understand and implement.

He admits implementing a document management solution seemed a little overwhelming at the time. "Knowing exactly what we wanted was essential," offers Brewer, "but a solid implementation plan up front was critical as well."

The document management system that has been in place since July 2010 is constantly being tweaked to improve performance and adjust to changes in the labs' processes. All professional staff in the lab use the system in one way or another.

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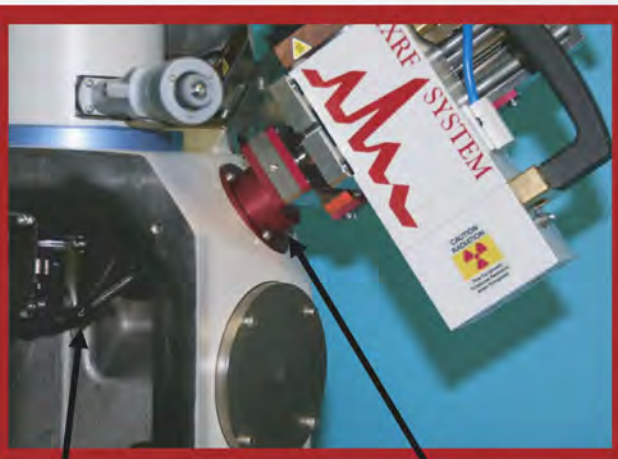

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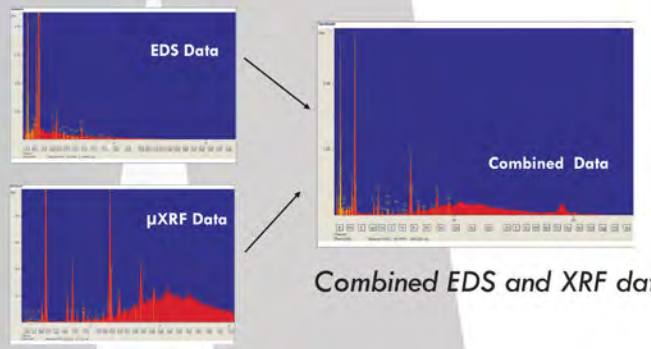

Combined EDS and XRF data

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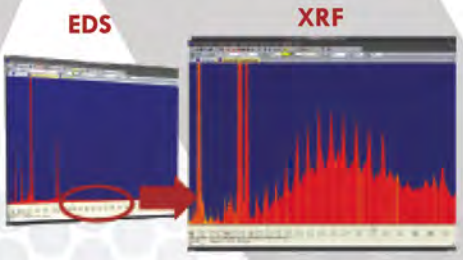

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IXRF SYSTEMS

Brewer and his department are using the system to its fullest potential. In addition to managing documents, Brewer and Assistant Quality Manager Holli Baker have created and customized workflows, provided training to staff, and tested the staff on specific skills. They manage reviews of scientific literature to ensure that the appropriate professionals see it. The quality management team also takes advantage of the custom reporting function that enables them to generate specific reports for the workflows or training offerings.

"Holli and I spend a fraction of the time we used to on managing our documents," says Brewer.

Brewer, who is known in industry circles for helping out his colleagues, has a few bits of advice for those considering implementing such a system:

1. Decide what you want the system to do. Spend time up front researching exactly what you want your system to do. Do your requirements gathering, in other words. And try to anticipate your needs as your department and its processes evolve.
2. Develop a step-by-step plan. Just as with any project, a step-by-step plan will be your road map. It will help your team members stay on the path and it will help you reach your goals in a timely fashion. Know that, depending on the size of your organization, the implementation process can take some time. It's worth stepping along slowly to get it right. Don't try to do everything at once. Start with document control first. As you get comfortable with that function, begin working on workflows, testing and training, reports, and so on.
3. Realize that continuous tweaks will be necessary. Your processes will evolve and improve and the system will need to be tweaked to match your improvements and changes in staff and organizational requirements. Know this up front and make sure that the system you select is flexible enough to handle the changes.
4. Structure the software around your management system. Accreditation bodies require forensic laboratories to have a structured management system. These are often similar, but most are unique. It is crucial for your documents and workflows to correspond to your particular management system. This takes planning and coordination between staff and the personnel who manage the compliance software. Make the system work for you.
5. Spend time on training. Change is difficult no matter how beneficial the change may be. Spend time and effort training your staff on the new program and you will reap rewards from staff buy-in and participation. This is key to successful implementation of a compliance software system. Make sure your solution provider is as committed to training and constant education as you are.

Brewer extolled the value of working with his peers. Soon after the lab began implementing the document management software, he along with a few other users developed a group e-mail list in order to share knowledge and improve the system. The result was a group of quality managers sharing best practices and offering solutions to each other.

"This field has evolved so much over the past two decades," says Brewer. "Who knows what the future will bring."

Hollywood producers haven't phoned Brewer just yet, but who knows when they'll find out how glamorous quality management really is.

Katie Gignac *is the marketing specialist for Qualtrax Inc., which develops and provides document, process, and training management solutions and compliance software for forensic labs and other industries. Qualtrax, Inc.; 105 Industrial Drive, Christiansburg, Va., 24073; 1-800-277-3077; KGignac@qualtrax.com, www.qualtrax.com.*

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Vince McLeod, CIH

Cutting Class

Recently we had the unpleasant experience of investigating a gruesome and nearly fatal accident. A maintenance worker was removing a cable tie from a package on the loading dock and his pocketknife slipped and punctured his thigh, slicing his femoral artery. If it wasn't for quick thinking co-workers and the fortunate proximity of the hospital emergency room the outcome might have been tragic. Luckily, compression was applied by co-workers well-trained in first aid and a very short trip to the emergency room saved his life. The real story here is that this accident was totally preventable.

The bigger story is that every year there are thousands of these types of accidents in every kind of business across the country. In one published report, the Consumer Product Safety Commission statistics indicated that nearly 40% of all medically treated injuries due to manual tools in the United States involved knives or retractable blades.[1] These injuries happen due to broken blades, accidental cuts while changing blades, inappropriate use or mishandling of utility knives, and of course, using the wrong tool for the job. In fact OSHA estimates that cuts and lacerations cost us about $300 million each year and that each cut averages around $3,000 when health care, workers' compensation, and loss time are factored in.

Forensic facilities are no exception when it comes to jobs requiring cutting or the use of sharp blades. I guarantee your facility has a shipping/receiving area and many other areas where cutting is done without a second thought. So in this issue the Safety Guys offer a few basic tips on safe use of cutting instruments and preventing accidents and close calls.

Let's Take a Look Around

Have you noticed all the different applications around your facility that require some type of cutting or use of a utility knife? Almost all workers have something to cut during the week. In fact, we bet many carry pocketknives or utility knives in their pockets, on their tool belts, or at arm's reach in a drawer or on the work bench. Some common uses to search for include opening boxes and packages; cutting cartons, string, or strapping material; slicing shrink wrap; opening bags; and general maintenance.

Utility knives are one of the most common tools used in the work place, yet one of the most dangerous, especially in terms of the number and types of injuries produced. We often take these tools for granted and the dangers of inappropriate cutting equipment and procedures are too frequently overlooked. Let's see if we can cut down on these injuries by taking a look at our cut-

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ting tools and some of the newer knives available and then evaluating a few tips on proper cutting techniques.

The Right Tool for the Job

Here we want to discuss some of the key features of utility knives and specialty cutting tools now available. We have all heard the phrase above many times—choose the right tool for the job and the job can be done more quickly and safely. The first rule is to carefully choose the tool to suit the material you are cutting. There are literally hundreds of knife designs and blade types to choose from, so match the task with the best design and blade. Ask yourself, is a utility knife the most appropriate tool? Would a pair of scissors or snips do the job better or more safely?

According to the CPSC, the most prevalent injury is a cut or laceration during blade changes. In order to minimize this risk look for tool designs allowing easy blade changes. Use of blunt tipped blades along with ergonomically designed and ambidextrous handles are also helpful. In-handle blade storage can save time and blade handling but the key is to make blade changing easy.

Cutters with permanent blade guards can protect employees as the blade is never exposed. These types of cutters also protect the package contents from damage. For many designs the protective guard acts as a guide to help position the cutter as well.

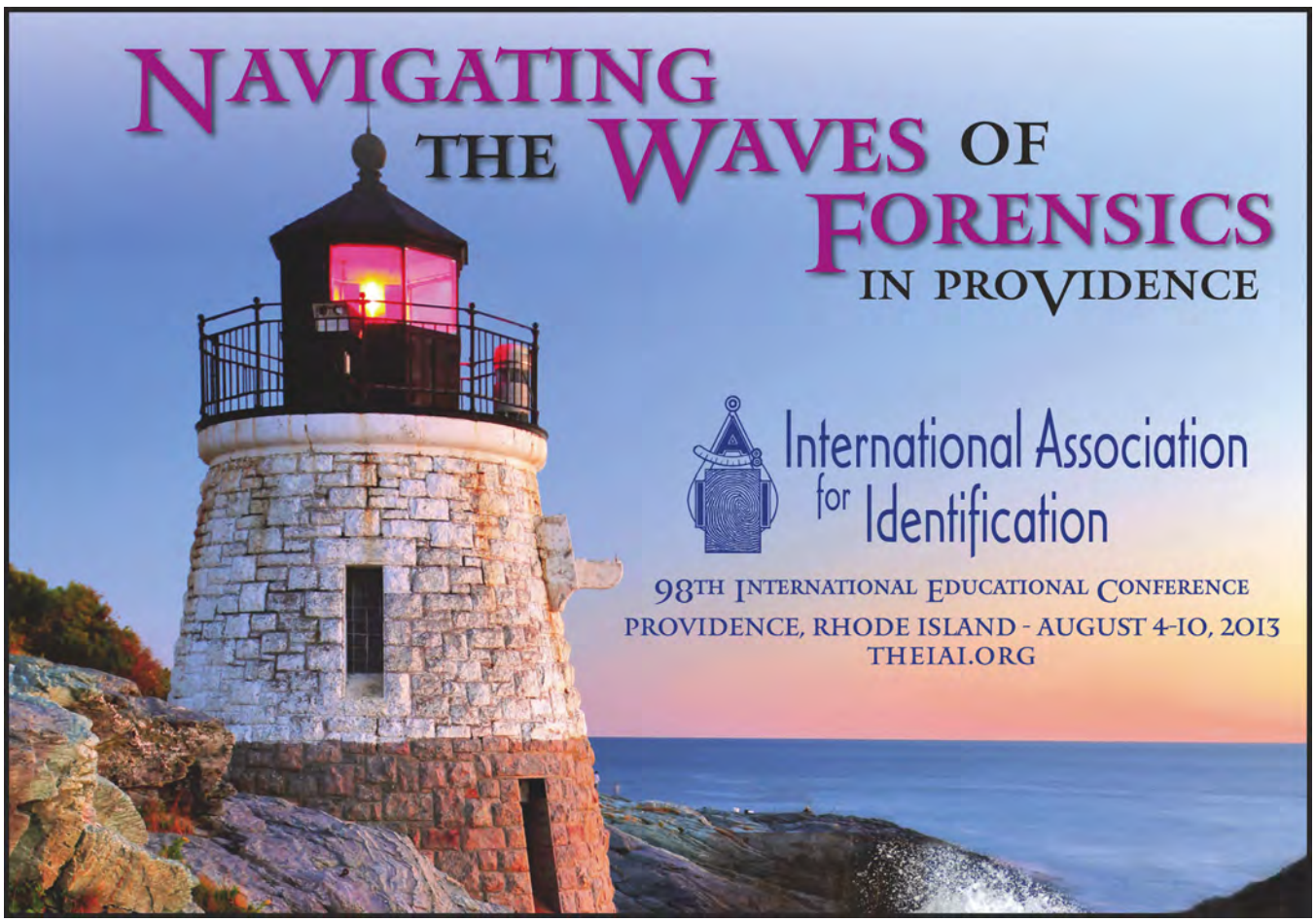
Another feature widely available in today's utility knives is the spring-back blade mechanism. This design functions to instantly retract the blade when it loses contact with the material being cut. The spring-back feature can dramatically reduce puncture injuries.

One of the newer design features for utility knives is the bi-metal blade. With the bi-metal technology process, two different metals are fused together using electro-beam welding. For utility knife blades this is usually high-carbon steel for sharpness and flexible spring steel that bends but does not break or shatter. These bi-metal blades can last significantly longer than plain carbon steel blades with one industry reporting a six-fold increase in use between blade changes.

These blades can help reduce injuries and increase safety in two ways. By staying sharp longer they reduce a worker's natural tendency to press harder as a blade dulls thus decreasing the chance of slips and blade shattering. And, since they last longer they reduce the need for blade changes lowering injuries accompanying that task.

Tips for Safe Cutting

Now that we have chosen the right tool for the task, let's review some rules for safe cutting. One good source for information can be viewed at the Vaughn Safety page for Safety Knives and Cutters.[2] Here are our top tips:



- Always wear safety glasses. You never know when a blade might shatter or a strap snap loose.
- Wear appropriate protective gloves, especially on the hand that holds the work piece being cut. The right glove not only protects the hand but can improve the grip as well.
- Always cut with a sharp blade. As we mentioned above, a dull blade requires excessive force increasing the chance for injury.
- Do not make blind cuts. This means to clear the entire length of the cut so nothing unexpected is encountered.
- Make sure you are balanced and your footing is stable and secure. Use a natural cutting movement. This will minimize chances of slips.
- Keep your non-cutting hand away from the line of the cut.
- Always pull the knife toward you when cutting on a flat surface. This is a safe, natural movement that provides the best control.
- If using a guide or straight edge make sure it is securely clamped.
- If the blade begins to tear the work rather than cutting, change the blade.
- Do not force a bend or apply side loads to the cutting blade. This is the primary cause of blade breakage.
- Do not use utility knives for prying or other non-cutting tasks.

Summary

Every workplace contains cutting tasks where utility knives are used. This most common work tool is too often taken for granted and a source for many unnecessary injuries. By observing your various cutting operations and the type of utility knives used you can ensure the proper tool is used for the task. Reviewing a few simple rules with employees can help prevent some of the most common and potentially dangerous workplace injuries. Be careful out there.

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1. 2011 Annual Report to the President and Congress, United States Consumer Products Safety Commission, Bethesda, MD. 2011 http://www.cpsc.gov/cpscpub/pubs/reports/2011rpt.pdf
2. Safety Knives and Cutters: Knife Safety Tips, Vaughn Safety, Inc. Arlington, WA. 2012 http://www.safetyknivesandcutters.com/t-knifeSafety.aspx

Vince McLeod *is an American Board of Industrial Hygiene Certified Industrial Hygienist and the senior IH with the University of Florida's Environmental Health and Safety Division. He has 24 years of experience in all facets of occupational health and safety and specializes in conducting exposure assessments and health hazard evaluations.*

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John J. Barbara

Mozilla Firefox Forensics: Part 3

Firefox SQLite RDMS

The majority of potential forensic information does not reside in the Windows Registry, but rather in two directories located in the individual User account(s). The first directory, "C:\Users\[User]\AppData\Local\Mozilla\Firefox\Profiles\xxxxxxxx.default\Cache\," stores the Firefox Cache which contains information about the various cache entries (metadata) and the cached items themselves (data). Cache entries can be of immense forensic importance. The other directory, "C:\Users\[User]\AppData\Roaming\Mozilla\Firefox\Profiles\xxxxxxxx.default\," stores the SQLite Relational Database Management System (RDMS). RDMSs are primarily used to store and manage User-defined records and generate data summaries and reports through the use of query commands that can access and combine data from multiple tables. The SQLite RDMS is a public domain software package which is an embeddable, integral part of an application and not a separate process that is accessed from a client. It does not require the use of a separate server process or system. SQLite RDMSs have a small default code footprint (around one megabyte), efficiently use disk space and memory (usually a couple of megabytes), and require no configuration. The entire database (tables, definitions, data, and indices) is stored on the host device as a single cross platform file which is locked during writing events.

Firefox Database Files

Each User on a system has his own SQLite RDMS in his profile and it is important to note that the data in the files is profile specific. Normally, the databases would be extracted from an acquired image and examined on a forensic machine using tools such as FoxAnalysis, SQLite Database Browser, Firefox 3 Extractor, sqlite3_analyzer, or SQLite Manager. However, data from any SQLite table can be viewed directly within Firefox itself by using the SQLite Manager add-on which also supports exporting the data to a spreadsheet. (It should be noted that a sophisticated User can manipulate the data by adding or deleting information from the files using this add-on).

Firefox (version 16.0.2) typically includes twelve SQLite databases, each of which performs a different function such as storing bookmarks, cookies, places visited, searches, and so forth.

Every SQLite database contains the "sqlite_master" table which defines the schema for that database. The number of other additional tables will vary depending upon the function of the database. All date/time stamps in the tables are stored as UNIX numeric values which can be decoded by using an application such as DCode.

addons.sqlite

There are four tables in the file: "addon," "developer," "screenshot," and "sqlite_sequence." The "addon" table contains all sorts of useful information such as the name of each add-on, its version number and description, its creator and the creator's URL, developer notes, a support URL, the homepage URL, and the number of total downloads. There could be add-ons listed here that the User is not aware of, such as additional toolbars. Selecting "Add-ons" from the main Firefox drop down menu will display the "Add-ons Manager" tab. Selecting "Extensions" on the tab will provide a listing of all add-ons.

chromeappstore.sqlite

There is one table in the file, "webappsstore2" which contains information regarding the search engine.

content-prefs.sqlite

There are three tables in the file, "groups," "prefs," and "settings." A User can set site-specific preferences for browsers and content settings (page style, text zoom, etc.). Those preferences can remain persistent across browsing sessions and page visits. Along with browser history, this is an indicator of intentionally visited sites and not accidental or casual visits. The sites visited are maintained in the "groups" table.

cookies.sqlite

Some Web sites use tracking cookies to create User profiles. Other sites use cookies for advertising purposes. The fact that a cookie is present does not necessarily mean that the User visited that site. When a User elects to remove cookies using Web browser functionality or a cookie-cleaner application, they may or may not all be deleted. Alternative cookie storage locations and the persistence of cookies and their processes can have an effect upon whether or not a cookie is deleted. Firefox stores its cookies in the only table in the file, "moz_cookies." Data of forensic interest can be found in the "baseDomain," "host," "lastAccessed," and "creationTime" columns.

downloads.sqlite
Firefox stores a list of all files downloaded in the "moz_downloads" table which is used to populate the popup download queue. They remain in the table as long as the User does not clear the queue. Valuable forensic information can be found in the table. The names of all the files downloaded, their source, downloaded destination, and the start and end times of the download are all recorded. If the data in the "currBytes" and "maxBytes" columns is the same, that is indicative that the download completed successfully.

extensions.sqlite
The file stores data about installed extensions and contains seven tables: "addon," "addon_locale," "locale," "locale_strings," "sqlite_sequence," "targetApplication," and "targetPlatform." The "addon" table contains valuable forensic information, some of which can be found in the "descriptor," "installDate," and "sourceURI" columns.

formhistory.sqlite
The file only contains one table, "moz_formhistory," but it stores a wealth of forensic information. All historical data for every form that a user ever filled out while online is maintained in the file! Potential probative data, such as e-mail addresses, actual names and addresses, phone numbers, and so forth can be found in the "value" column. Also the "firstUsed" and "lastUsed" columns record the date/timestamp information associated with the data. Additionally, if a User entered any search terms into the search bar, they will be recorded in the "fieldname" column under the "searchbar-history" entries.

permissions.sqlite
The file contains a history of the permissions that are assigned to various sites, for example, whether or not pop-ups are allowed. The data is stored in the file's only table, "moz_hosts" and the sites are listed in the "host" column.

The remaining four tables, "places.sqlite," "search.sqlite," "signons.sqlite," and "webappsstore.sqlite" will be discussed in the next Digital Forensics Insider column.

Software mentioned should not be considered as an endorsement by Forensic Magazine or by the author. Prior to purchasing or obtaining any tool, investigators and examiners should research those that are available to determine which best meet their technical and operational performance parameters. After procurement, the tools functionality must be verified.

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Streck
www.streck.com

product showcase

Rapid DNA

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LGC Forensics
www.lgcforensics.com

Autosomal STR Kit

The PowerPlex® Fusion System, a 24-loci multiplex, is an autosomal STR kit offering high discrimination and delivering more information in demanding forensic, paternity, and relationship-testing cases, without the need for instrumentation or software upgrades. The System works well with extracted DNA samples and allows direct amplification from numerous sample types. Rapid cycling protocols help enable swift turnaround times.

Promega
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DNA Match Analysis

Cybergenetics TrueAllele® computer technology accurately analyzes challenging DNA evidence. Available as in-house product or outsourced service, TrueAllele provides objective DNA match statistics. TrueAllele resolves DNA mixtures having two to six contributors, handles degraded and touch DNA, and offers kinship analysis. TrueAllele includes a probabilistic genotype database for informative DNA investigation. Cybergenetics also provides expert witness and court preparation services for TrueAllele interpretation results.

Cybergenetics
www.cybgen.com

STR Kit

The GlobalFiler™ STR Kit combines reduced amplification time with maximum data recovery power. As part of a fully integrated and validated forensic workflow, this 6-dye, 24-loci technology is designed to deliver unprecedented lab performance. And, it's backed by Life Technologies training, service, and support.

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how it works

Confirming and Quantifying Multiple Opiates in Urine Using a Single Quadrupole GC-MS

Problem: Structural similarities of opiate metabolites introduce challenges to the accurate separation, confirmation, and quantitation of these substances. Opioids compose a chemical class of both naturally occurring compounds produced from the opium poppy plant (*Papaver somniferum*) and similar synthetic analogues. Substances within this class are commonly recognized as potential drugs of abuse. Biological matrices containing heroin (*diacetyl morphine*), codeine, morphine, hydrocodone, hydromorphone, oxycodone and oxymorphone, and thebaine are regularly monitored by drugs of abuse analysis laboratories.

Solution: A forensic toxicology method for the confirmation and quantitation of codeine, morphine, hydrocodone, hydromorphone, oxycodone, and oxymorphone in human urine was developed using the Thermo Scientific ISQ single quadrupole GC-MS system. Multiple analytical procedures can be replaced by this method, which combines a dual derivatization technique with the selection of the correct analytical column.

Results: The dual derivatization technique led to the successful separation of all six opiate compounds.

Optimized instrument parameters and the selection of the 1 phase column versus a 5 phase analytical column eliminates compound coelution and interference.

Linearity ranged between 30–5000 ng/mL for codeine, morphine, hydrocodone, hydromorphone, oxycodone, and 30–1200 ng/mL for oxymorphone. This supports both directed assay and retest samples while also reducing the need to re-extract concentrated samples.

Correlation coefficients (R2) better than 0.9960 for all analytes based on a one point calibration further demonstrates sample concentration range capability.

Intra and inter-batch precision of <5% CV (Coefficients of Variation) at 120 ng/mL and 375 ng/mL ensure confidence in the measured result and achieve reliable results day in and day out. Limit of quantitation at 30 ng/mL using a 2 mL sample size allows the analyst to achieve required detection limits with limited sample volume.

Figure 1: Thermo Scientific ISQ single quadrupole GC-MS system.

Conclusion: A method was developed to demonstrate the performance of the ISQ GC-MS system for the confirmation and quantitation of six opiate compounds in a urine matrix. The chromatographic performance of the TraceGOLD™ TG-1MS analytical column with the optimized parameters of the ISQ GC/MS provided fast run times without coelution interference, ensuring accurate confirmation and quantitation. The assay described offers broad linearity to cover a wide range of analyte concentrations, with R2 values of 0.9960 or higher for all analytes. The coefficient of variation for intra- and inter-batch precision was shown to be less than 5% for 120 ng/mL and 375 ng/mL concentrations, demonstrating excellent precision. Limits of detection and quantitation at 30 ng/mL ensure sensitive performance for retest and directed assay samples. With the final analyte, oxymorphone, eluting at a retention time of less than five minutes, the methodology offers a productive means for confirming the six-opiate panel. Laboratories save time and money by using a single extraction, single injection, and a fast analysis time, while achieving results that are quantitatively accurate and precise across a broad concentration range.

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Ken Mohr

International Forensic Facilities: A Question and Answer Session

While representing Crime Lab Design, I have made many international friends that now hold a special place in my heart. Having traveled to their home countries and having had the opportunity to share in the design and planning of both new and renovated forensic facilities with them; I would like to better inform the forensic community just how important international forensic science facility projects are and how they can help grow the international forensic community.

This has been facilitated by ICITAP and their goals to: 1) Maximize organizational efficiency - We provide solutions that achieve high performance adjacencies designed to improve floor plate organization and building stacking efficiency. 2) Ensure the economical expenditure of resources - We will not take a forensic lab designed previously and place it in a foreign country. We will take the lessons learned from the past projects and blend them with the knowledge of local resources to arrive at the best solution for the agency in their region of the world. 3) Develop a safe, secure, and well-designed facility - We continue to introduce international facilities to modular planning as this approach ties laboratory bench design to the prevailing structural system to maximize the lab furniture systems, facilitates hazardous zoning in the lab, and creates clear exit paths.

Over the years designing, planning, and programming such facilities, I have come to know Mr. Daniel Garner. Dan is recently retired from the International Criminal Investigative Training Assistance Program (ICITAP) as their Chief of the Forensic Services Division. He has graciously accepted to help me tackle this topic by answering some questions about ICITAP and its goals.

Daniel D. Garner, Ph.D. served for 13 years as ICITAP's Chief of the Forensic Services Section under the Criminal Division for the U.S. Department of Justice. Prior to that Dan was the President of Cellmark Diagnostics, Inc. and the Chief for the Forensic Science Laboratory for the U.S. Treasury Department under the Bureau of Alcohol, Tobacco, and Firearms. He has also served as a professor of Forensic Science and has produced over 40 scientific publications and presentations.

Q: What benefits are there to the United States supporting International Forensic Laboratories?

A: Having partner forensic laboratories in other countries is increasingly of major benefit to the U.S. in the investigation of multi-national criminal activity and the subsequent prosecution of the criminals. Historically, international criminal activity occurred on the border of two countries and generally involved smuggling goods and/or people from one country to the other. Now the smuggling activity continues but involves the transportation of goods and people from one continent to another and sometimes beyond. Indeed, news reports have indicated that illicit drugs manufactured in South America have been shipped to Europe through Africa. And it is not just drugs that are being transported clandestinely but anything that can be sold or traded for profit such as stolen vehicles and art, firearms, counterfeit software and currency, exotic animals and plants, and people for slave labor or the sex trade.

These multi-national crimes can be complex and difficult to investigate for a number of reasons including the simple fact that some of the jurisdictions (governments) involved might not work well with others for a variety of political, religious, or racial reasons. Assuming two or more national jurisdictions are willing to work together on a criminal investigation, the sharing of forensic information could be limited due to incompatible scientific/technical systems such as DNA databases of different genetic markers or automated fingerprint databases using different algorithms.

Assuming these countries that want to share forensic information have compatible systems, then a remaining question concerns the quality of the data. Are all of the countries working to high quality standards in establishing their databases or did one (or more) of the countries have lower standards resulting in decreased quality of their data? It should be intuitively obvious that corrupted data would have a negative impact on the information that was to be shared from those databases which, in turn, could have an adverse impact on the criminal investigation and subsequent prosecution.

Q: Why design the International Forensic Labs to U.S. standards, guidelines, and accreditation issues?

A: For the past 25 years, the U.S. Department of Justice, working with and funded by the U.S. Department of State, has identified forensic laboratories in specific countries to collaborate with in order to facilitate the exchange of forensic information in joint investigations. Under the concept that two laboratories working to the same quality standards could exchange and rely on each other's data, efforts were focused on assisting foreign labs achieve ISO accreditation. As one would expect, the individual forensic laboratories in various countries are as varied as the countries themselves and therefore the assistance provided to them was customized to their specific needs, but with the common focus of assisting them to attain ISO accreditation. Assistance provided to all foreign laboratories included the management aspect of operating a modern forensic laboratory to international quality standards. Additional assistance was provided based upon the needs of the individual laboratory but could include technical training in any of the forensic disciplines, donation of scientific and technical equipment, renovation of facilities, and the design and construction of new laboratory facilities.

Q: How critical is pulling the right team together?

A: The design of new or renovated forensic facilities has been critical in several international forensic collaborations. While the requisite architecture and engineering skill sets is not generally resident in U.S. forensic laboratories, there are several firms that have considerable experience designing forensic facilities.

Q: What benefits can be realized through ICITAP?

A: The results of forensic examination conducted in an ISO accredited forensic laboratory in any country, by competent, well trained examiners using quality controlled procedures on adequate instrumentation and equipment in a properly designed facility should be reliable and useful in criminal investigations and subsequent prosecutions, regardless of venue. To be able to rely on forensic examinations conducted in a foreign laboratory should result in savings in both time and costs.

In summary ICITAP helps international forensic communities operating modern forensic laboratories to international quality standards and helps develop and upgrade forensic facilities, staff, and resources to better combat crimes, both in their own countries and in working cooperatively on international crimes. I want to thank Dan Garner for answering these questions on ICITAP.

Ken Mohr *(kenm@crimelabdesign.com) is a Principal and Senior Forensic Planner with Crime Lab Design which provides full architectural and engineering services for forensic and medical examiner facilities worldwide.*

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Dick Warrington

Properly Packaging Evidence

Preserving and maintaining evidence collected at a scene is crucial. The key is understanding evidence and understanding the proper way to package it.

First, a few important points: Choose packaging of the proper size and material for the evidence. Package each piece of evidence separately, and properly label, seal, and document it. Evidence tape is designed to fracture easily to indicate tampering; it's not meant to hold bags shut and boxes together. Use packing tape to seal bags and boxes, then place evidence tape over the packing tape. Sign across the tape, with half the signature on the tape and half on the package. That way, your evidence will be securely packaged, and you'll notice any tampering.

For basic collection, you'll need an assortment of clean, new paper and Ziploc bags. Never use an old paper sack or an old plastic bag, or you risk contaminating your evidence. If you put a sweater from the scene into an old grocery bag and the lab finds a hair, they won't know if it came from the bag or the sweater.

Use Ziploc bags for items, such as nuts and bolts, that won't be processed further. Keep different sized bags on hand, since you want to match the item to the bag.

Paper should be used for items that need to breathe. Fingerprint evidence, pillows, comforters, etc. go in paper. Wet items go into paper. If you seal a bloody shirt in a Ziploc, it will putrefy and be ruined. Put bloody clothing into paper bags and transport to your station. While it's drying, place white paper bags under the clothing to collect any trace evidence that falls. Retain the transport bag and white paper bags as evidence. Green marijuana also needs to go in a paper bag; if sealed in plastic, it will mold and won't test properly.

Package small items carefully or they could be lost. If you have a single fingerprint on a flap lifter, attach it to an evidence sheet, and then package it in a 5 inch x 7 inch manila envelope. Use trace evidence lifters to process clothing, furniture, and similar items. Put the protective sheet over the adhesive, then tape it shut to keep the evidence in place. If you find a piece of hair or other loose evidence, collect it with tweezers and place it in clean pharmaceutical paper. Put both in a glassine envelope, fold it, and seal it shut. Again, place these small items in larger envelopes, seal, and label.

Electronic items require special attention. Cell phones can be activated and deleted from remote sites, which could destroy valuable information. Place cell phones in special bags that block signals and protect from static electricity. These bags can also be used with computer components. If you're going after computer equipment, bring an expert. Otherwise, you could shut off a computer and discover it was set to automatically delete data. After the expert checks it, then put the hard drive and other sensitive components in protective bags. Any parts that are too large to be packaged need to be documented with a property tag or label.

At some scenes you'll have DNA evidence. If you use swabs on blood, semen, saliva, or urine stains, let them air dry at the scene. When they're dry, pack each in a separate swab box or put each in a separate coin envelope.

Some items may present challenges because they pose a safety risk. Secure this evidence while also protecting yourself and others. Package large, oddly shaped items like machetes in cardboard tubes designed for posters. Place other sharp objects like syringes and glass fragments in specially designed plastic collection tubes. Knives can go into these plastic tubes or into specially designed knife boxes. A knife box allows you to strap the weapon in without damaging the evidence. If any of these items contain blood, other body fluids, tissue, etc., you must mark the outside of the package with a biohazard label.

When dealing with firearms, first make sure that the weapon is unloaded, cleared, and safe. Then pack the firearm in a box specially designed to hold weapons in place. The outside package label must indicate that the weapon has been cleared. If the weapon has blood or tissue, mark the package with a biohazard label. Again, this label is important because it will alert the lab to safety issues and will also indicate that biological testing needs to be done before ballistic testing. Also remember that the ammunition from firearms should be packaged separately.

Knowledge of proper evidence packaging goes a long way. Many law enforcement property rooms and state crime laboratories have their own specific guidelines for how evidence should be packaged and submitted. Familiarize yourself with their protocol. Go to your local lab. Ask how they want evidence packaged. The evidence you collect could make or break the case. Take the time to preserve its integrity and give your case the best shot at success.

Dick Warrington *is in research and development and a crime scene consultant and training instructor for the Lynn Peavey Company. dwarrington@peaveycorp.com*

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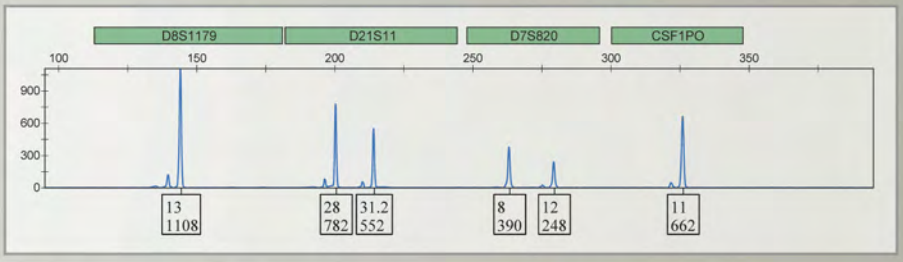

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